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PowerPoint Unveils Coordinate Confusion

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Synopsis

After six months of working in aerospace, I was tasked to brief, via PowerPoint in teleconference, important customers on the resolution of a seven-month problem that had its roots in coordinate confusion. This article gives my preparation techniques for this PowerPoint presentation and lessons learned from observing other presentations. For people interested in the bare essentials and as an easy guide for students, I've included an outlined checklist at the end of this article.

Introduction

After working in a large engineer-dominated aerospace corporation for only six months, I was tasked to deliver a PowerPoint brief to our customer management. This was not the standard weekly work review; it was a special presentation on the mathematical resolution of a high profile problem that had plagued the system for seven months. I was new to PowerPoint, and this was my first significant brief.

Then, on the morning of my brief, at the very last minute, our customer pushed back my brief to the end of the agenda. I surmised, after being bombarded by indecipherable PowerPoint presentations myself those first six months, that a math PowerPoint brief presented by a mathematician dialing into the meeting from a remote location was neither a popular nor expected to be a fun event. However during the morning while "listening" to the meeting, I now had time to rehearse my talk in my head. My manager's nervous twitching mannerisms, two cubicles away, betrayed his insecurity about a new employee briefing an important customer.

When my big moment arrived, my adrenaline surged, and I reminded myself to speak slowly. My first few minutes, I was on "cruise control" speaking from memory ingrained after hours of preparation work. My nervousness subsided shortly and, gaining composure, I explained that the problem had its roots in coordinate confusion; basically different analysis groups were pointing their thumbs in different directions. I fielded questions and then closed my talk asking, "Are there any more questions?" One customer gushed, "Though I do not understand the mathematics in depth, I understand the idea, and thank you!" Another customer sent me an e-mail, with my manager's address in the cc line, praising my clarity. I even acquired a fan who subsequently attended all my major presentations.

Now, let me confess that I am not a natural born speaker, but by the time I was whisked into the PowerPoint world, I could easily adapt board/transparency talks to a new medium. My slow, painful progress toward good presentation skills involved availing myself of every public speaking opportunity, pushing myself relentlessly to improve, and relying on loads of tips that I had learned or discovered throughout the years. Although PowerPoint was a new medium for me and presented some new challenges, I could see that many of the basics for giving a good PowerPoint presentation were the same as for any successful talk: the speaker, the message, and the audience must connect dynamically so that communication happens.

In this article, I'll walk through the preparation techniques that I used for my "Coordinate Confusion" PowerPoint brief. I chose this particular talk as an example because I faced the challenge of communicating a mathematical idea to an audience not fluent in mathematics and possibly anxious about their lack of mathematical sophistication. Nailing the problem, a skill at which mathematicians are adept, was critical to system performance and budget. The next step, delivering a presentation that yielded understanding of the mathematical concepts involved was vital to proper execution of the solution and prevention of future similar errors. Though this is a specific circumstance, many of the tips, lessons learned, and observations that I share in this article apply to a variety of situations whether a research seminar, a colloquium, a fifteen minute conference talk, or a classroom lecture.

For people solely interested in a checklist, I've attached an outline at the end of this article. The outline includes added details not included in my story. You are welcome to adapt them for your specific needs.

Preparing and weaving a story

Over the years, I had learned that time management was a critical first organizational step. Therefore, when I first began working on my presentation, I mentally mapped out a schedule designating time blocks for major tasks. My time blocks for preparing this talk included organizing a story, crafting the talk onto slides, sending slides to colleagues for review, rehearsing, and transferring the slide package to the final destination. To keep urgent situations from triggering a panic attack, I built time "error bounds" into my schedule. For tasks involving technology or people, I counted on the unexpected and planned especially large time margins. Doing so would give me flexibility to adapt and reprioritize as needed.

Because PowerPoint allows the audience to see only one slide at a time, I knew that my listeners would better process and remember information if I prepared a well organized talk that unraveled an interesting story. To better focus myself, I first contemplated my purpose—tell a story so that nonmathematical customers could easily understand our infamous seven-month coordinate confusion crisis. I then identified necessary critical points to be included, such as why the error occurred and how we could resolve it. For political reasons, I would emphasize that the error was easy to make, given the mathematical subtleties and the huge amount of data, together with the vast number of people and systems involved. Though never explicated stated, I also aimed to demonstrate, to those engineers who considered mathematicians pedants, that the careful analysis and precision of thought that mathematicians provide could earn its keep.

I was now ready to outline my talk. The statement of the problem, emphasizing its seven-month duration, together with a resolution announcement was a natural audience-grabbing introduction. I supplied background information by reminding the customers that, after several problem-free years, suddenly three different analysis groups had produced three different measurements on a single test case. Thereafter, this had continued to be the situation until I elicited the experience of our group's local veteran mathematician who quickly solved the puzzle. Then for dramatic affect and to pique curiosity, I would announce that he had discovered two errors, two self-correcting errors! When one group discovered and fixed one error, errors in analysis revealed themselves further along the data flow. Therefore, I needed to illustrate the three-way data flow to different analysis groups.

Then I would gently weave in the mathematics that explained the problem and its solutions. Finally I would conclude by reassuring the customers how all three groups were fixing the errors and our methods for moving forward to ensure this problem would never reoccur.

Next, I opened PowerPoint and took advantage of the fact that it supplied me an easy tool for organizing, modifying, and refining presentations. On the first slide I wrote the title with my name and organization. On the second slide I mapped out an agenda that would logically define the structure of my talk. I inserted some empty slides and then a "Backup" slide. As I developed my talk, I molded the content into my outlined story, doubly checking that ideas flowed logically with effective transitions. As I began to weed and craft, I pushed old slides to the end, after the "Backup" slide. In order to assess whether I had woven a well-organized story, I used *slide sorter view* to observe all the slides together and rearrange as necessary. To keep myself organized, I began each working day with a "save as" and added the date onto the package name.

Finally, as I zeroed into the guts of the talk, I had to be mindful that I had only thirty minutes to communicate a problem that had stumped a multitude of engineers and halted the system for seven months. Realistically, I could not expect that people, not steeped in mathematics, be able to understand the linear algebra details. However they could grasp the gist of coordinate confusion. To help me explain the idea at the appropriate level, I recalled the struggles of past linear algebra students and my own incomplete understanding when I first started at this job. Then I was very careful to break information into manageable doses in order to give time for fresh minds to absorb and reflect.

Once I was satisfied with the story line, I reviewed my presentation by trying to imagine that I was receiving this information for the first time. Focusing on my purpose, I examined once more what to include or exclude. Did I include crucial examples and explanations? Did the historical background enrich the narrative or was it superfluous? Did my slides clarify ideas precisely and succinctly? What unnecessary information could I delete? Slides with good, but possibly too much detailed information, I sent to the "backup" section in the event that someone might ask a question. Lastly, I tried to anticipate questions. After I was satisfied that I had captured a well-told story, I then polished my individual slides.

Crafting PowerPoint slides

PowerPoint, with its many options that are simple to use and fast to implement, tempted all my secret artistic aspirations. Exquisite colors, intriguing fonts, and picturesque background designs enticed me to dazzle the audience with my artwork. Commands such as "insert sound" and "fade to black" begged me to entertain and delight. After I played, painted, and decorated, I sternly reminded myself that overly expressive colors, ornate fonts, and fancy transitions detract from the focus of a talk. For this talk, the best artistic style was classic simplicity, and accordingly I used the conventional group template with its default background settings. Besides, there was no need for animation. I'd save dramatic effects for storytelling.

Because my tendency was to be thorough, I had to resist cramming every supporting fact on a slide. I recollected having witnessed a higher-level manager relentlessly grill a young engineer during a PowerPoint presentation the latter had prepared, where the slides were littered with detail and displayed no discernibly highlighted main points. When the manager finally grasped the essence of the engineer's work, she unnerved both the engineer and his managers by exclaiming, "Is that all you do?" Therefore, I followed the advice of one customer who dictated the $1 \times 7 \times 7$ rule: fewer than seven lines on one slide, and fewer than seven words per line. Basically, state simply.

In order to give my audience the opportunity to quickly glance at a slide, listen, and think, I planned to speak for three to five minutes on every simple slide. Each slide conveyed one message, summarized in the title. I highlighted main points in simple clear phrases in outline form with readable fonts. I inserted text "take-away" boxes at the bottom of the slides to restate and focus on key points. These also served to transition gracefully to the next slide. In the event that I would need to elaborate or access details, I inserted hyperlinks to "backup" slides with return links. Simplifying the slides helped me limit the amount of information to be doled out to my listeners.

PowerPoint provides some great features to enhance a talk. Here are a few that I used in my "Coordinate Confusion" brief to the customer. From PowerPoint's Smart Art graphics, I built a flowchart to illustrate the data flow from system to system in order to clarify why three groups had produced three different test measurements. Along with using color to differentiate, I incorporated dots, dashes, and patterns to distinguish lines and objects, since my project lead was colorblind. To illustrate the coordinate confusion

involving the horizontal/vertical system used in ground antenna systems and the azimuth/elevation coordinate basis for space, I chose a slide layout where I could exhibit two pictures of the coordinate systems side by side. For the second coordinate conversion error, I placed two 2×2 complex matrices side by side. The two matrices looked almost identical, but buried in those two arrays of complex numbers was one difference—a minus sign in one position, highlighted in bold font. Because I was not going to be controlling the computer at the customer site, PowerPoint's handy feature of introducing one line at a time while speaking was not a viable option. However, keeping slides simple, this limitation was not a problem.

After crafting my slides, I obeyed my grade school teachers and proofread. I also inserted necessary headers and footers and then numbered the slides. After that, I asked a trusted colleague to check content accuracy and look for tiny mistakes. Besides giving me the "okay," colleagues have enlivened my talks with a choice phrase, enriched my narrative by explicating another perspective, or provided feedback by asking an insightful question.

Energizing an Audience

Transforming a mind-numbing, information-packed talk to one that would engage, energize, and impact my audience necessitated that I step outside my academic mathematical world and tailor my presentation to fit the background, interests, and viewpoints of my audience. Instead of reveling in mathematical beauty, I now needed to target engineers and managers concerned with the practical day-to-day problems of budgets, schedules, and program decisions. These people were dedicated and conscientious, but most likely were not at ease with mathematics.

I hoped that empowering my intended audience with knowledge would be a spark to ignite their enthusiasm and add a bounce to their step as they left my presentation. Knowledge gained, especially if perceived as elusive or difficult, can feed an ego. Besides, the ability to articulate clearly to one's management could be a boost to job advancement.

As I prepared to pitch to managerial customers, I immersed myself into their culture. I reflected on items and issues from past talks that engaged my designated listeners, the questions they asked, and comments made afterwards. To determine how my listeners preferred information, I perused

the slides of past PowerPoint presentations to acquaint myself with the protocol for structuring a customer brief, level of detail expected, and degree of formality. I learned proper technical language and shared acronyms and jargon, so that I could speak their language.

Although I designed my "Coordinate Confusion" PowerPoint slides for a thirty-minute top-level information brief to the customer, I knew that these slides on this much-discussed problem would reach an audience far beyond them. Analysts with technical backgrounds would be listening and questioning the newcomer's expertise. After my talk, my PowerPoint package would be archived in public folders, posted on the company's internal site, or even passed around through e-mail. To reach my second-tier audience, I employed the following two strategies. First, I added hyperlinks to an explanatory, mathematically rich backup slide with a "return" hyperlink to satisfy technically hungry analysts listening in their cubicles from afar. Next, I wrote supporting exposition on the notes pages for the after-the-talk audience. A reader viewing the package on "Notes Page" mode then could look at the slides on the screen's top half and read the notes page exposition on the bottom.

Shining On Stage

After translating my "Coordinate Confusion" story to PowerPoint, I turned my attention inward and attended to my oral presentation skills. I certainly did not want to risk delivering a monotonous soliloquy, an unfocused rambling sermon, or a talk punctuated with "ums" and uncomfortably long silences. I dreamed of shining stardom, and I knew that in order to achieve my lofty goal, I would need to practice.

Here was my practicing modus operandi. In order to better focus on a productive practice session, I did not fight my public speaking anxieties, but rather accepted that stage fright was natural. In fact, many accomplished public speakers suffer from stage fright. Since this was an important brief, I wrote my talk in conversational style on paper to better edit for proper grammar. Then looking onto an imaginary audience, I narrated my story as if talking to a friend. My emotional temperament and my exhilaration that a mathematical abstraction had serviced this practical community guaranteed a naturally animated voice, varying in tone and emphasis. I purposefully did not read, since reading could degenerate quickly to a rhythmic and lulling

cadence. When I stuttered, I stopped, rephrased my stilted sentence, and re-spoke. Though practicing smoothed my language flow, my jitters tended to increase my pace. I therefore wrote "pause" at strategic places in my notes.

When I practiced my brief I imagined looking at my audience, although, in reality the brief was to be via teleconference, and this presented a challenge. I would not be able to harvest visual clues to assess attention or interest. Therefore, I would need to remember to state the slide number to keep the audience in sync and pause for questions between slides. For this short information-transfer brief, I could not employ my other two strategies—elicit discussion with comments and questions and address people by name in order to take away the anonymity of the situation.

From practicing, my confidence grew as the talk became ingrained into memory. I was also assured that I would meet my designated thirty-minute time slot. Consequently, by the time of my talk, I was able to direct attention toward my listeners, make myself approachable, and turn my listening dial to high. At the beginning of that matter-of-fact brief, I simply stated, "Please interrupt and ask questions anytime." I answered each question respectively and then inquired if my response made sense. During my pitch, when one customer echoed, "two self-correcting errors," I acknowledged his amazement by responding, "Yes, the second error undid the mistake of the first," and then paused for him to grasp this outrageous snafu. Shining stardom is less about the star and more about the ability to touch an audience with a message.

Concluding Remarks

From my customers' reactions after my brief, as recounted in my introduction, I knew that I had accomplished my mission. The mathematician's work would not lie dormant. Moreover, as with many lucid math talks, this one helped to wedge open reticent minds, erase boundaries between fields, and promote collaboration. Then again, if it had not been for the eloquent private lecture that the local mathematical problem solver delivered to me, this talk would not have been. When handing me the solution, he explained the roots of the problem that had baffled others for seven months patiently, clearly, succinctly, and in my language, that of mathematics.

Whatever the outcome, I always take time to reflect on successes, failures, and ways to improve. Did people ask questions? Were they involved? How did other speakers handle a similar situation? I typically ask colleagues for feedback, and use negative critiques as a growing opportunity. Each presentation, even a flop, offers a new learning experience. Giving an effective PowerPoint presentation is both an art and a science that requires time, energy, and experience.

PowerPoint is a powerful, useful communication tool in both academia and the business world. Academics use PowerPoint for lectures, online learning, and talks. At a corporation, PowerPoint is a daily, multi-purpose tool used for giving status reports, sharing technical expertise, making decisions, and training. In business and for academic researchers alike who must share information with colleagues at different locations, teleconferences with PowerPoint or a relative such as Beamer or Prezi is essential. Then, after the presentation, the PowerPoint package might be archived for future reference.

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A Checklist for Giving an Effective PowerPoint Presentation

First Steps

- Identify purpose of presentation: Is it to inform, teach, train, or make a decision?
- Clarify specific objective or goal: What do you want to communicate to audience?
- Identify and assess audience.
- Make a schedule and pace yourself.

Preparing the Talk

- Prepare an outline.
  - Introduction: Encapsulate purpose/objective with a clear thesis statement.
  - Background: Review pertinent information.
  - Main Body: Support and develop objective with ideas that flow in a logical manner.

  - Conclusion: Summarize main points, reinforce purpose, and suggest a way forward.
  - Break information into sections so that there are opportunities for questions and discussion.

- Content
  - Thoroughly research and develop the topic with supporting detail.
  - Stay focused on the topic; delete unnecessary terms and facts.
  - Clarify ideas and state in a concise, direct manner.
  - Consider basic motivations, analogies, crucial examples, explanations of principles, descriptions of results and methods, risks, impacts, pros and cons, options, connections with other subjects, and historical comments.
  - Anticipate questions.

- Technical accuracy
  - Use proper technical language and vocabulary appropriate for audience.
  - Explain unusual technical terms, symbols, and acronyms.
  - Do not give incorrect information or state opinion as fact.

Transforming the Talk to PowerPoint Charts

- Slide format
  - Use a simple template and keep the same design from slide to slide.
  - Standardize position, and limit font, colors, and styles.
  - Select color with care (a number of men are color blind).
  - Contrast background color with font color
  - Use simple clear phrases or pictures, large enough for everyone to see.
    * The 1 x 7 x 7 guideline (fewer than 7 lines per slide, and fewer than 7 words per line).
    * The first letter of the first word is capitalized; rest of the words in lowercase.
    * Font size should be at least 18 point.

- Structure sequence of slides
  - First slide is the Title slide.
    * 32–40 point font size for the title
    * 20 point font size for a subtitle, if you have one, and your name.
  - Second slide maps out an agenda.

  - Main Presentation Slides.
    * Plan for 3 minutes presentation per slide.
    * One message per slide summarized in the title (32 point font).
    * Take away box, on bottom of slide, serves to focus on a key point or transition to the next slide.
  - Back up slides for nonessential supporting information.

- Slide Content
  - Use pictures, flowcharts, graphs, and charts to aid explanations and illustrate ideas.
    * Graphs: include title, legend, units on the axes
  - Evaluate detail; too much can be distracting, but too little detail does not add to your talk
    * Write supporting exposition in the notes pages.
    * Hyperlink to backup charts, a webpage, or another document.
  - Use animation wisely
    * Simulations of complex concepts
    * Sequence flows
    * Sections of a busy concept diagram

- After assembling slide package
  - Proofread for correct spelling, punctuation, and grammar.
  - Remember headers and footers
  - Number the slides.
  - Ask a colleague to proofread.

Before the Presentation

- Practice and craft talk to fit the time frame.
- Identify and make arrangements for audiovisuals and other resources.
- Know how to use the equipment.
- Visit the room, if possible.

Delivery

- The Speaker
  - Place yourself at an angle between screen and audience in order to easily glance at the screen and then back to the audience. Hold notes in front of you.
  - Smile, make eye contact with a live audience, and show enthusiasm.
  - Keep reading to a minimum.
  - Speak naturally, but loud enough for all to hear. Vary voice and pace of speech.
  - Vary sentence structure, and try to use active rather than passive voice.
  - Avoid slang and such expressions as "ok," "like," "you know."
  - Pause frequently
    - Provides audience time to absorb, think, or ask a question
    - Emphasizes and makes an impact
  - Keep an eye on the time, be prepared to adjust presentation by deleting or adding information
  - Be yourself; do not imitate another person's style.
- Engaging the audience.
  - Begin with something that stimulates interest (an inviting question, interesting fact or story, something humorous).
  - Give something that touches personally (interesting idea to mull, clarifying an elusive concept, another perspective that motivates a response, humor)
  - Ask questions and elicit feedback.
  - Paraphrase questions from your audience to ensure that everyone has heard the question and to clarify your understanding.
  - Be sensitive to any remarks or comments that might be offensive.
  - If a listener asks a question for which you have no answer, reply that you do not know and offer to find the information for them, or ask the audience. Indicate any guesses and conjectures as such.
  - Conclude by reinforcing the central idea, leave with something to take with them (where the subject might go in the future, how your listeners might become involved, a rhetorical question or provoking statement for reflection).
- Teleconferences present special challenges.
  - State the slide number.
  - Engage the audience: pause between major transitions to elicit comments or ask a question.
  - Address people by name.

After the Talk

- Reflect on your successes or ways to improve your presentation.
- Did people ask questions? Were they involved?
- Ask your colleagues for feedback.